

Amendments to the Claims:

1-122 (Cancelled).

123. (Previously Presented) A method for entangling a quantum state of a first qubit with a quantum state of a resonant control system, the method comprising:

tuning a resonant control system, which is capacitively or inductively coupled to said first qubit, to a resonant frequency for a period of time, wherein said resonant frequency corresponds to an energy difference between a first energy level and a second energy level of said first qubit, thereby entangling the quantum state of said first qubit with the quantum state of said resonant control system.

124. (Previously Presented) The method of claim 123, wherein said resonant control system is an anharmonic resonator.

125. (Previously Presented) The method of claim 123, wherein said resonant control system is superconducting.

126. (Previously Presented) The method of claim 123, wherein said resonant control system comprises a Josephson junction and a bias current source that is connected in series with said Josephson junction, and wherein said tuning comprises altering the magnitude of said bias current source.

127. (Previously Presented) The method of claim 126, wherein the magnitude of said bias current source is $0.994 \cdot I_c$ or less during said tuning, wherein I_c is the critical current of said Josephson junction.

128. (Previously Presented) The method of claim 126, wherein the magnitude of said bias current source is $0.990 \cdot I_c$ or less during said tuning, wherein I_c is the critical current of said Josephson junction.

129. (Previously Presented) The method of claim 123, wherein said period of time is one microsecond or less.

130. (Previously Presented) The method of claim 123, wherein said period of time is one hundred nanoseconds or less.

131. (Previously Presented) The method of claim 123, wherein said period of time is long enough for said quantum state of said resonant control system to entangle with said quantum state of said first qubit.

132. (Previously Presented) The method of claim 123, the method further comprising: applying a first quantum gate to said first qubit prior to said tuning; and applying a second quantum gate to said first qubit after said tuning.

133. (Previously Presented) The method of claim 132, wherein said first quantum gate is a Hadamard gate and said second quantum gate is a Hadamard gate.

134. (Previously Presented) The method of claim 123, wherein said coupling of said first qubit to said resonant control system is described by a native interaction Hamiltonian that includes an off diagonal interaction term.

135. (Previously Presented) The method of claim 123, wherein said first qubit is a superconducting charge qubit or a superconducting phase qubit.

136. (Previously Presented) The method of claim 123, wherein the resonant control system is capacitively or inductively coupled to a plurality of qubits, wherein the plurality of qubits includes said first qubit.

137. (Previously Presented) The method of claim 123, wherein the first qubit is a superconducting qubit.

138. (Previously Presented) The method of claim 123, wherein the first qubit is described by a native interaction Hamiltonian that includes a diagonal interaction term.